



August 24, 2012

File No. 2012-07037

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Reference: Whitacre Greer Permeable Boardwalk Brick Paver Permeability Testing  
Hawthorne Park – 12<sup>th</sup> and Catharine Streets  
Philadelphia, Pennsylvania

## INTRODUCTION

This letter summarizes the results of the surface infiltration testing conducted on Whitacre Greer's permeable Boardwalk brick paver system at the above referenced site. To facilitate the study, Gilmore & Associates, Inc. (G&A) performed single-ring infiltration tests at three locations in Hawthorne Park on July 30, 2012. The Whitacre Greer permeable Boardwalk brick paver installation was completed in March 2012. The purpose of this investigation was to establish post-construction infiltration rates for stormwater passing through the pavement surface into the open-graded base materials. This testing did not examine infiltration of water into the soil subgrade.

## SETTING

Hawthorne Park is a flat, relatively open site along 12<sup>th</sup> and Catharine Streets in Philadelphia. The brick walkways are bordered by grass and planting beds, with small trees located sparsely throughout the site. See the attached Location Plan for the testing locations.

The brick pavement system at Hawthorne Park was installed on a compacted section of three aggregate layers listed from bottom to top as follows: a minimum of 12 inches of open-graded No. 1 aggregate placed over the soil subgrade; a 4-inch layer of No. 57 aggregate; and a 2-inch bedding layer of No. 9 aggregate. Non-woven geotextile fabric was placed on top of the soil subgrade prior to placing the No. 1 aggregate. No. 9 aggregate was placed within the paver unit joints. Based on information provided by the brick manufacturer, the herringbone brick layout of the pavement has 11 percent void space. A detailed design-and-build pavement cross-section taken from the site civil plans, prepared by LRSLA Studio, is attached for reference.

## PROCEDURE

A single-ring infiltrometer was used to test the surface infiltration rate of the clay brick pavement per ASTM C1701. This testing method was developed for pervious concrete applications, but can be utilized for other permeable systems such as brick pavement systems. The single-ring infiltrometer consisted of a 0.25-inch gauge, 12-inch diameter, 10-inch high steel cylinder. The ring was placed on the pavement so that a representative infiltration area was exposed at the cylinder base and then sealed to the pavement surface with plumber's putty. Water was added to the single-ring per ASTM

C1701 and the time was recorded when the required amount infiltrated into the pavement system. The surface infiltration testing was performed two times at each location in accordance with the ASTM standard.

#### INFILTRATION RESULTS

An average surface infiltration rate of 561.6 inches per hour was observed at Location A. An average surface infiltration rate of 965.7 inches per hour was observed at Location B. An average surface infiltration rate of 870.3 inches per hour was observed at Location C. The average post-construction surface infiltration rate for the permeable Boardwalk paver system is 800 inches per hour. The infiltration results for the three locations are outlined in the Appendix.

#### FINDINGS/RECOMMENDATIONS

This testing supports the use of these clay brick pavement systems as a pervious (permeable) infiltration surface. The initial surface infiltration rate of the pavement system is significantly faster than what can be expected of most surface soils. Additionally, these results confirm that the pavement surface has an initial flow-through rate greater than 5 inches per hour, as specified in the site civil drawings.

Like all permeable surfaces, clay brick pavements can become clogged with sediment over time, leading to reductions in the surface infiltration rate. As stated in ICPI's *Permeable Interlocking Concrete Pavements* Manual, traffic and sedimentation can vary widely with every project; therefore, regular surface cleaning is recommended at least once or twice in the first year, with more or less cleaning being performed as needed thereafter.

G&A recommends that infiltration testing be completed again in one year, so as to document the brick pavement's performance and refine system maintenance recommendations as needed.

G&A appreciates the opportunity to provide Whitacre Greer with engineering consulting services. Please contact us with any questions.

Respectfully submitted,



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MCH/TGW/dmk

Enclosures: Appendix & Photographs

## **APPENDIX**

Permeability Testing Summary Table  
Whitacre Greer Permeable Boardwalk Brick Pavements  
Hawthorne Park – Philadelphia, PA  
G&A Project No. 2012-07037  
August 10, 2012

**Test Date – 7/30/2012**

**Location A**

<b>Prewetting (8 lbs. of water)</b>	<b>Test 1 (40 lbs. of water)</b>	<b>Test 2 (40 lbs. of water)</b>	<b>Average Infiltration Rate (in./hr.)</b>
15 seconds*	67 seconds	59 seconds	<b>561.6</b>
	<b>Infiltration Rate per ASTM C 1701</b>	<b>Infiltration Rate per ASTM C 1701</b>	
	526.0 in./hr.	597.3 in./hr.	

**Location B**

<b>Prewetting (8 lbs. of water)</b>	<b>Test 1 (40 lbs. of water)</b>	<b>Test 2 (40 lbs. of water)</b>	<b>Average Infiltration Rate (in./hr.)</b>
9 seconds*	37 seconds	36 seconds	<b>965.7</b>
	<b>Infiltration Rate per ASTM C 1701</b>	<b>Infiltration Rate per ASTM C 1701</b>	
	952.5 in./hr.	978.9 in./hr.	

**Location C**

<b>Prewetting (8 lbs. of water)</b>	<b>Test 1 (40 lbs. of water)</b>	<b>Test 2 (40 lbs. of water)</b>	<b>Average Infiltration Rate (in./hr.)</b>
10 seconds*	41 seconds	40 seconds	<b>870.3</b>
	<b>Infiltration Rate per ASTM C 1701</b>	<b>Infiltration Rate per ASTM C 1701</b>	
	859.6 in./hr.	881.0 in./hr.	

\*If during prewetting, 8 pounds (1 gallon) of water infiltrates in less than 30 seconds, the infiltration test shall be conducted with 40 pounds of water.

ASTM C 1701 Infiltration Rate Calculation

$$I = (KM) / (D^2t)$$

- Where:
- I* = Infiltration Rate (in./hr.)
  - M* = Mass of Infiltrated Water (lbs.)
  - D* = Inside Diameter of Infiltration Ring (12 inches)
  - t* = Time Required for Measure Amount of Water to Infiltrate (sec.)
  - K* = 4,583,666,000 in SI Units or 126,870 in (inch/pound) units

## **PHOTOGRAPHS**



**Hawthorne Park  
Whitacre Greer Permeable Boardwalk Brick Walkway**



**ASTM C1701 Single-Ring Infiltrometer Test**